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The Alberta Agricultural Research Trust 1983-1984

Annual Report

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Chairman's Report

In 1983-84, the Alberta Agricultural Research Trust (AART) adopted a significant change in its policy for approving research projects.

This change represents the most significant alteration in the AART's research funding process since the Trust's establishment in 1966.

To make greater use of its available funding and to spur development of new sources of research support, for 1983-84 the Board of Trustees decided to require all new AART projects to obtain a portion of their funding from industry.

This approach is intended to develop other sources of financing and promote greater involvement by private industry. In addition, it will encourage research managers to develop projects that are acceptable both to the Trust and to the private sector.

Research is a cornerstone of Alberta's agricultural industry. Agriculture has prospered and grown because producers in this sector are regularly able to implement new technology developed both inside and outside of our province.

To remain competitive in the global marketplace, Alberta's agricultural industry will become even more dependent on the availability of new technology. It is here that the Agricultural Research Trust has been meeting the needs of Albertans for 18 years: the Trust assists in developing this technology and in ensuring that new management techniques, crop varieties, livestock strains, and new approaches to handling disease and other pests are available to producers. In addition, the Trust attempts to provide similar resources and services to the processing and marketing sectors of our agriculture industry.

Central to meeting industry's needs is the ability to diversify, to incorporate new knowledge and technology into existing production and to generate new knowledge and technology to fuel future advances. These are objectives that the Trust hopes to achieve through the research it supports.

For the majority of projects it has supported, the Trust has followed the route of the traditional funding agency by offering 100 percent financing to a number of new and ongoing projects. All current projects are being conducted by university researchers, a traditional source of new technology for Canadian agriculture.

Despite the change in funding practice, the AART continues to depend heavily on Alberta Agriculture for support. A $500,000 grant from Alberta Agriculture provided the AART's first operational funding, and the Department has granted the Trust an additional $250,000 each year to continue its research support efforts.

In 1983-84, the Alberta Agricultural Research Trust supported 34 projects worth more than $530,000. This total includes matching funds provided by those in the private sector supporting AART projects. This brings the Trust's total research effort since inception to about 300 projects which have received approximately 5.3 million in funding support.

While the Board arrives at decisions through a number of operating guidelines, one guideline, above all, is crucial — that all research supported by the AART be relevant to Alberta's agriculture industry. In this regard, the Board feels its efforts have continued to be successful.

On behalf of the Board of Trustees of the Alberta Agricultural Research Trust, I extend our appreciation to the participating research scientists, the Grants Committee and to those organizations and businesses which have risen to the challenge and provided strong financial support to agricultural research activities in Alberta during the past year.

H.B. McEwen
Chairman, Board of Trustees

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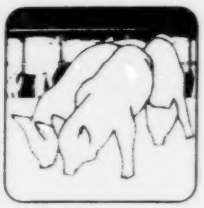


ANIMAL SCIENCE

PRICE, M.A.

The use of growth stimulating anabolic agents in beef production from young bulls and cull cows

The effects of the anabolic agent Ralgro on growth rate and carcass composition were studied in older (>4 years) and younger (<4 years) culled female cattle. It was found that Ralgro significantly increased growth rates in the younger group by 7-8%, but had no significant effect in the older group. Doubling the dose rate caused no change in response. There was no significant influence of the substance on any carcass characteristics although there was a tendency for it to increase muscularity in the younger group. It is suggested that Ralgro affected only 'true' growth, and that the older cows were undergoing 'catch-up' rather than 'true' growth and so were unaffected by the stimulant.

A second study was conducted to identify any effects of Ralgro on young feedlot bulls, since it had been suggested that Ralgro may act via the thyroid to reduce basal metabolic rate. If so, it might be anticipated that Ralgro would modify behaviour, making the bulls a little more lethargic, and hence easier to manage and less susceptible to dark cutting. The effect of Ralgro on sexual development was also investigated.

The bulls were implanted at weaning (which is also about puberty), and reimplanted at about 80 day intervals. Ralgro caused a slight increase in growth rate and there was some evidence of increased docility among implanted bulls. Sexual development (testicular development, libido and semen quality) was not found to be affected by implanting, but libido and semen quality were low in all bulls. Ralgro was not found to have any significant effect on carcass traits or grading, but while 40% control bulls were dark cutters, 10% of implanted bulls showed this undesirable carcass trait.

YOUNG, B.A.

Climatic influences on nutrition in cattle

The heat required to raise the temperature of ingesta to body temperature has been ignored as a component in winter feeding of cattle. Clearly, practical situations exist where this component places a significant thermal load on animals and therefore on productivity. This project showed the extent of cooling and that the relative contribution to reduced productivity was influenced by the quantity and rate of cooling, as well as by the physiological state of the animal and ambient temperature. Understanding of the interactions between the animal and ingesta-induced cooling allows for the adoption of feeding systems to minimize the impact on productivity. For example, a thermal-stable, large, well-insulated animal on a high feeding level may, without ill effect, tolerate large single meals of cold ingesta, whereas smaller, poorly-insulated stock suffer unless small quantities of dried feed are offered over an extended daily feeding period.

FOOD SCIENCE

HADZIYEV, D.

Effect of storage temperature on some rehydrating properties of potato granules

Dehydrated potato granules consist of unruptured cells filled with gelatinized starch matrix. With the addition of hot water or milk they are reconstituted into a product that resembles freshly mashed potatoes. The rate of rehydration of granules in cold water is of paramount importance in producing high quality extruded French fries. Rehydration rates of 5.9×10^{2} sec^{-1} are ideal. Such rates are achieved by Ca^{2+} addition during granule production or by storage at 25° for 6 months, which is commercially impractical and can result in off-flavor development. It was found by us that starch matrix retrogradation is related to starch matrix rehydration rates. An accleration of retrogradation was achieved by storage of granules at low temperature. In this respect, a systematic study was provided for the effect of storage temperature on granule rehydration rates, swelling power, water binding capacity, starch-cell wall separation and crystallinity degree of Freeze-Thaw and Add-Back potato granules — all major parameters in the production of extruded French fries.

The results showed that at 4° C storage, the optimum rehydration parameters were achieved only after 3.5 months of granule storage. Hence, Ca^{2+} addition in a granule process still remains the practical option for granules aimed for extruded French fries and other granule-based snack foods.

LeMAGUER, M.

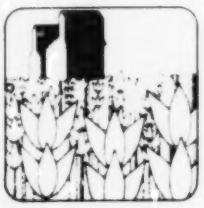
Effect of pretreatment on the texture and rehydration properties of air dried foods

Pretreatments with mixtures of water-salt-ethanol and water-sucrose-ethanol were successful in improving the texture of diced carrots and potatoes after rehydration. The salt and sucrose only penetrate slightly and affect mostly the surface of the material. They prevent caking and maintain plasticity of the surface. This is essential since upon drying extensive shrinkage occurs (more than 90% change in volume) with irreversible changes in the structure under normal processing conditions. The ethanol, on the other hand, deeply penetrates the material and is particularly useful in maintaining plasticity and replacing water, implicitly realizing dehydration. The gain here is more on the energy savings than on the quality improvement. In summary, the combined effect of the above components realizes energy savings and texture improvement of the finished product.

OORAIKUL, B.

Dehydration of vegetables: Improvement of drying and reconstitution characteristics with physical and chemical pretreatments

Several pretreatment methods, e.g. precooking in $CaCl_2$ solution, cooling, freezing and thawing, dipping in glycerol solution and in surfactant emulsion, were applied to grated potatoes to produce dehydrated hashed-browns in order to improve their dehydration and rehydration characteristics. It was found that precooking (70° C/25 min) then cooling grated potatoes in water containing 200 ppm Ca^{++}, followed by steam cooking for 10 minutes, dipping in 5% glycerol for 30 miniutes and Myvatex (surfactant) emulsion for 30 minutes before drying in a fluid bed dryer offered the best combination with respect to drying and rehydration rates and degree of breakage of the product. Constant rate period of drying was increased from 0 to 10 minutes, thus drying to 7% moisture was accomplished in less than one hour. The product is lighter in color and more porous in texture, having a bulk density of 0.15 g/cc as compared to 0.23 g/cc for a commercial product. The resultant hashed-browns rehydrated fully in 20 minutes while the commercial sample took more than 35 minutes. The percent breakage of the product subjected to the series of pretreatments was reduced to less than 10% from 19% for the sample not so treated. Studies are still in progress to evaluate other physical and organoleptic properties of the product.



PLANT SCIENCE

BAILEY, A.W.

Cattle use of brush on apsen parkland rangeland

Grasslands were generally preferred by cattle over shrubland or forest although browse was found to be a normal part of the cattle diet in the native aspen parkland rangeland. Cattle are principally grazers but browsing ranged from 7 to 28% of total foraging time. Major sources of browse were wild rose, aspen, saskatoon, and in late summer, western snowberry. Cattle use of aspen suckers was substantial at the forest edge where aspen forest was invading native grassland. Mortality rates of aspen suckers was 37% under heavy grazing and 21% under light grazing. They were greater with June (47%) than with October (7%) grazing.

BAILEY, A.W.

A brush control system for controlling aspen forest using herbicide followed by fire

Picloram pellets at the recommended rate of 1.12 kg/ha were the most effective herbicide on aspen poplar killing 60% of the trees over two years. Burning caused the level of mortality to increase to 88% and severely damage the remainder. In spite of the high tree mortaility subsequent suckering of shrubs and aspen resulted in high densities of live woody stems. The most common woody stem after herbicide or herbicide plus fire was western snowberry. A bioassay three years after herbicide application revealed that picloram was still present in the soil. A single application of herbicide with or witout burning was found to not be successful in controlling aspen where grazing was not included as a followup treatment.

Six herbicide treatments were aerially applied on apsen forest in July 1979. One half of each block was burned in April 1981. The effects of treatments were evaluated in the summers of 1980 and 1981 on trees, shrubs, grass and forbs.

The 1.12 kg/ha rate of picloram pellets was the most effective herbicide on aspen poplar killing 41% of the trees by 1980, 60% by 1981; after prescribed burning, mortality rose to 88%. The remaining

12% of aspen trees were severly injured. Other treatments caused lower rates of mortality. A prescribed burn by itself killed 34% of the trees outright and damaged the remainder. Subsequent mortality would be expected. Regardless of treatment, woody sucker regrowth was substantial in this study where no grazing occurred. In the most effective treatment, in 1981, there were 276 and 527 live stems/10 m^2 in unburned and burned plots, respectively. About 75% of live stems were western snowberry, a shrub that is relatively resistant to picloram. In the associated Ph.D. thesis research of R.D. FitzGerald, which was supported by other funds, he found that short duration grazing by cattle could control this sucker regrowth.

A bioassay for picloram was made three years after application. Soil sampled from the top 10 cm of the A horizon three years after application showed 0, 0.1 and 1.0 parts per billion picloram in control and high application rates of liquid picloram and pelleted picloram, respectively. Burning had no significant effect on soil applied picloram.

BRIGGS, K.G., R.J. BAKER

Effects of plant density on the performance of ten barley cultivars

The effects of plant density on yield and related traits were studied in ten cultivars of spring barley, *Hordeum vulgare* L., to determine if selection in low density stands is effective in improving expression in dense stands. Five plant densities (1.6, 6.2, 25, 100, and 400 plants/m^2) were evaluated in each of 3 years.

Spikes/plant, shoot weight and grain yield were the only characteristics that had significant cultivar x density interactions. All three characteristics increased asymptotically as density decreased and did not show significant changes in cultivar rank.

Interplant variability, although minimum at a density of 100 plants/m^2 for spikes/plant, shoot weight and grain yield, showed a significant decrease at a density of 6.2 plants/m^2 (40 x 40 cm) for all traits. Our results show that single plant selection may be most effective at plant spacings near 40 x 40 cm and that selection under low densities should be effective in improving dense seeding expression of yield and several related traits.

BRIGGS, K.G., R.J. BAKER

Comparison of grain yield of uniblends and biblends of ten spring barley cultivars

Pure stands (uniblends) of ten cultivars of spring barley (*Hordeum vulgare* L.) and the 45 possible 50:50 mixtures (biblends) were evaluated for 3 years in four-replicate randomized blocks. In addition to plot grain yield, data were collected on grain weight, shoot weight, and harvest index from 20 plants (10 in 1977) sampled from each uniblend and from 10 plants of each of the components of each of the biblends. Single plant sampling was carried out in only two replicates in each year. Cultivar identification in the biblend samples was facilitated by evaluation of spike and seed characteristics of each plant.

Analyses of whole plot yield and of single plant data indicated that there were not significant differences between average performances in uniblends and biblends. Absence of significant interaction implied that relative cultivar performance in uniblends and biblends was the same. These results suggest that intergenotypic competition among relatively well adapted genotypes should not be of serious consequence in barley breeding programs.

BRIGGS, K.G., R.J. BAKER

Relationships between plant density and yield in barley

To determine the effects of plant density on shoot weight and grain yield of spring barley, *Hordeum vulgare* L., ten cultivars were planted on square grids at densities of 1.56, 6.25, 25, 100 and 400 plants/m^2 in each of 3 years, 1977-1979. Twenty plants were harvested from each plot (one replicate in 1977; two in 1978 and 1979) for determination of total shoot weight and grain yield per plant. The yield/density relationship was best described by the reciprocal regression equation, $w^{-1} = a + bd$, where w was the total shoot weight or grain yield (g/plant) and d was the plant density (plants/m^2). Coefficients of determination varied from 66.4 to 99.5% with an average of 89.1% for grain yield. The coefficient a, a measure of apparent maximum yield per plant, was influenced primarily by differences among cultivars. On the other hand, b, which is an estimate of the asymptotic yield per unit area, showed a significant cultivar x year interaction for both total shoot weight and grain yield.

CLARK, E.A.

Interspecific competition in pastures under continuous and rotational grazing management

The Pembina Forage Association (PFA) has now completed the third production year of their ongoing rotational grazing study. In 1982, liveweight gains were increased to 350 lb/ac from a high of 300 lb/ac in 1981. The extra beef gains were achieved in spite of somewhat lesser forage yields and a shorter grazing season than in 1981.

Key features of the improved beef productivity in the PFA pasture were:

1. *A heavier stocking rate* - 198 yearling steers on a quarter section, compared to 135 in 1981: and

2. *More uniform and complete grazing* - resulting from additional 2-wire cross fencing to produce 8, 20-ac paddocks from the 4, 40-ac paddocks used in 1981; and from consistently short regrowth and grazing intervals.

Factors reducing beef gains from what might have been expected included:

1. *Weak regrowth*, particularly in the second and fourth quarters of the season, such that much of beef gain during these intervals was produced from mature forage; and
2. *Unfavorable growing conditions*, due to a drought in June and to unseasonable cold in August.

Taken together, the patterns of forage growth and regrowth, apparent forage use, and rates of live weight gains suggest that beef gains in 1982 were limited more by quality than by quantity of available forage. Further increases in beef productivity will likely require increased attention to sustained regrowth, rather than on concentrated June growth as a source of later grazing. Causes of weak regrowth must be clarified, to distinguish climatic factors, over which there is no control, from managerial factors, such as heavier early stocking, planned haying or top clipping, which may be applied to support higher beef gains in 1983.

KONDRA, Z.P.

Evaluation of genetic variability in breeders' seed of licenced varieties and selections of rape (B. Napus L.)

Breeders' seed populations of the varieties Midas, Regent and Altex and line 75G-908 were grown in isolation plots in 1977. Eighty single plants were harvested at random from each population to provide seed for progeny plots (lines) in 1978. A breeders' seed bulk, 79 lines and a composite bulk of the 79 lines, for each genotype were field tested in a 9 x 9 balanced lattice design with three replications at Ellerslie Research Station. Data were collected on days to first flower, last flower and maturity, plant height, seed yield, oil and protein content.

The statistical analysis indicates that one or more lines were significantly different from their corresponding breeders' seed bulk for all the characteristics except protein for Regent and Midas. For Altex and 75G-908, this was the case for all characters except yield and protein.

The results indicate that there is a need to alter the method of developing breeders' seed population in rape. Lines should be developed from each population to assess days to first flower and maturity, and plant height to eliminate the extreme types to provide agronomically more uniform populations for the producer. These assessments can be made on unreplicated increase plots. The variability within breeders' advanced lines can be exploited for the recurrent plant breeding method.

KONDRA, Z.P.

Evaluation of synthetic varieties for the exploitation of hybrid vigor in rapeseed

Hybrid vigor is a major genetic component of agronomic performance in Polish rapeseed (B. campestris L.). Hybrid vigor is best exploited in hybrid F1 varieties which are not currently feasible in *B. campestris*. Synthetic varieties are the second best method for utilizing hybrid vigor. Yield could be increased by 10-20%.

Two procedures were to be evaluated. 1. Self-pollination to produce a series of S1 populations. 2. Paired crossing to produce sib-mated populations. Both types of populations would be utilized to produce test crosses to assess average combining ability. The ACA data would allow selection of combinations of populations for intercrossing to produce synthetic varieties for field assessment. The project was initiated in the greenhouse in the winter of 1980-81. S1 seed set was very difficult to achieve. Seed set was satisfactory in the sib-mated populations. Greenhouse problems prevented the harvest of mature seed. Similar results were achieved in the winters of 1981-82 and 1982-83.

The suggested procedures for development of synthetic varieties of *B. campestris* are unsatisfactory. A possible alternative is the vegetative multiplication of genotypes through several biotechnology techniques. This would provide a large number of plants with identical genotypes so that many identical crosses could be made to produce adequate seed for Average Combining Ability testing.

RURAL ECONOMY

HAWKINS, M.H.

Market innovations and price behavior — Alberta hogs

This study has evaluated the market performance of the Alberta Pork Producers' Marketing Board since it became the single selling agency for hogs in Alberta in 1969. Concepts of pricing and operational efficiency were applied, with comparisons made with the alternative market areas in Winnipeg, Toronto and the average of seven U.S. markets. Market information was also assessd for effect on operational and pricing efficiency.

Cost reductions in the hog marketing system were used to assess operational efficiency. Cost savings were documented and attributed to the Producers' Hog Indemnity Funds, the assembly yard system, the hog allocation system, the "check float mechanism", and the hog settlement procedure.

Pricing efficiency was evaluated using graphical, statistical and econometric methods. Results from these techniques were compared among market areas during various time periods, which represented policy changes of the Board.

The major conclusions from this study were that the Board's selling and market information procedures improved operational efficiency. However, a firm conclusion concerning pricing efficiency could not be made because of mixed evidence. It was recommended that other commodity interests could benefit from becoming involved in co-operative selling through a single selling agency.

LEROHL, M.L., M.H. HAWKINS

Canadian grade standards and export market potential

The project examined the cost of the number of combinations of grade and grains handled by a sample of Alberta Country elevators, based on data provided by two major elevator firms. While the number of grades/grains handled by a country elevator does affect costs, the added costs were modest for those grain/grade combinations dealt with by sample elevators. In general, reducing the number of grades/grains handled by five (average per elevator was 16), would decrease elevator costs by about 1 percent.

However, lower elevator costs were associated with increased capacity of the country elevator, with decreased age of the elevator, and with an increased receipts-to-capacity ratio of the elevator.

MANNING, T.W.

The potential impact of rising energy prices on the use and allocation of resources in grain production

The effects of energy prices on the productivity and costs of grain production were studied for the period 1926 to 1981, with special emphasis on the period 1969 to 1981. Agricultural productivity in general and grain productivity in particular continued to grow during the 1969 to 1981 period. The prices of petroleum products, the major energy input of grain producers, rose rapidly from 1972 to 1981, but the prices of labour and many other inputs rose as fast or faster. In addition, grain prices rose substantially during the 1970's. As a result, energy costs declined relative to both total costs and incomes for grain up 1980. Energy costs seem to have increased relative to grain income and other costs in 1981 and 1982 but this may be a short-term fluctuation.

PETERSEN, T.A.

Fallowless cropping in the dark brown soil zone

This project was completed October 1, 1983 and the results are reported in detail in a graduate student M.Sc. thesis completed by Mr. Nithi Govindasamy.

Extensive analysis was done on the key variable, stubble/fallow yield ratios, using yield data from farmers directly and the Alberta Hail and Crop Insurance Corporation; a simulation model was used to test the probable outcome of a typical farmer adopting several rotations with different levels of fallow in each. Results suggest that reduction of fallow in the cropping sequence adds substantially to income instability, but with rising grain prices and the adoption of new moisture-conserving technology now being developed, individual farmers can increase their average incomes and equity over a period of years, although for many, the relatively small increase in average returns may not be enough to offset the problem of dealing with uncertainty caused by yield and price variability. There appears to be a strong need for further research in, and extension of technology which will increase the yields of grain on stubble versus that which can be obtained on fallow.

WESTERN COLLEGE OF VETERINARY MEDICINE

CRICHLOW, E.C.

Forestomach mechanism mediating rumen stasis in lactic acidosis

The data obtained in this study indicate that rumen fluids collected during loss of reticulo-ruminal motility in sheep experiencing ruminal lactic acidosis from induced grain engorgement, can cause activation of forestomach epithelial receptors isolated in anesthetized sheep. Moreover, rumen fluids obtained between 4 and 6 hours following grain engorgement were more effective in eliciting receptor activity than rumen fluids collecied before or after this period, including rumen fluids obtained at ruminal stasis. Since the concentrations of undissociated volatile fatty acids (VFAs) in the 4 and 6 hour post engorgement rumen fluids were much higher than those obtained in the other samples, attaining a mean value of 10.62 (± .54SE) and 11.80 (± .45SE) mmol/L respectively, the effectiveness of these rumen fluids may depend on their levels of undissociated VFAs.

The minimum concentrations of undissociated VFAs required to excite isolated forestomach receptors were higher than the levels of VFAs found in the rumen fluids of acidotic sheep. However, if the integrity of the reticulo-ruminal epithelium was disrupted by exposure to a corrosive agent i.e., mild solutions of NaOH, the minimum concentrations of undissociated VFAs which evoked activity was reduced being at times lower than that found in the rumen fluid samples.

GROOM, S.C.

Pathogenicity of Haemophilus somnus in the bovine respiratory tract

The preliminary case control survey of necropsy material ran for 8 months and was completed in December, 1982. *H. somnus* was recovered from 23% of all bovine pneumonias and 33.5% of cattle under 1 year of age. Isolations from beef calves were higher than from dairy calves. The average age of affected dairy calves was 1.5 months and the average age of beef calves was 8.5 months. Clinically calves may die with little sign of respiratory disease and feedlot calves as well as calves on pasture can be affected in outbreaks with high mortality from *H. somnus* respiratory disease. Grossly the lungs have cranioventral consolidation with sub-acute fibrinous bronchopneumonia. Histopathologically lungs from which *H. somnus* was recovered in pure culture had chronic changes in comparison to the acute changes present in mixed infections.

The work in Edmonton represented a 5 year retrospective study of submissions to the Veterinary Services Laboratory. The 5 year isolation prevalence was 15.0%. The clinical, gross and microbiological findings were similar to findings from the 1982 Ontario survey. The difference in isolation prevalences reflect bias in the submission rate of feedlot cattle.

The year long Ontario case-control study was completed. Results are very similar to the previous Ontario study and Edmonton survey. Antibiotic treatment prior to carcase submission was shown to significantly reduce *H. somnus* isolation but not *Pasteurella* spp. Recovery of the organism from dairy animals had no seasonal incidence; beef isolation from feedlot calves peaked in December and January. This reflects differences in management between the two types of animal.

Intratracheal inoculation of 3-4 month old calves has indicated strain differences in pathogenicity and ability to induce pneumonia. This follows a pattern already observed with isolates that have a particular affinity to cause septicemic disease and reproductive disease. The experimentally induced pneumonias were acute bronchopneumonias and were inconsistently typical of natural cases from which *H. somnus* has been isolated.

These findings are significant for a variety of reasons. The isolation prevalence is higher than previously reported indicating the importance of proper isolation methods. The suggestion is that the importance of *H. somnus* in bovine pneumonias may have been underestimated in the past and *H. somnus* may represent an important bacterial respiratory pathogen. *H. somnus* has been found predominantly in chronic bronchopneumonias not acute fibrinous pneumonias as previously reported. Also the clinical, gross and microbiological findings are similar in Ontario and Alberta. Lastly, experimentally induced broncho-pneumonias have demonstrated strain differences in pathogenicity which may be important in the development of vaccines against septicemic disease and/or respiratory disease.

MAPLETOFT, R.J., A. BIELANSKI, W. JOHNSON, U. SCHNEIDER

Factors affecting survival of bovine embryos in low temperature storage

A series of experiments were designed to investigate various factors contributing to survival of bovine embryos frozen in liquid nitrogen. In the first experiment dimethylsulfoxide (DMSO) was used as a cryoprotectant to -40°C. Two equilibration times with DMSO and three thaw temperatures were compared. Ten minutes for each of three steps to add DMSO to embryos and a thaw temperature of 30°C provided highest survival rates.

In the second experiment, DMSO was compared to glycerol as a cryo-protectant. Glycerol provided the highest survival rate of embryos. In the third experiment, two final concentrations of glycerol (1.0 M vs 1.5 M) and three plunge temperatures into liquid nitrogen (-25° vs 30° vs -35°C) were compared. Plunge temperatures of -30°C and -35°C were superior to -25°C for embryo survival. Embryos frozen

in 1.0 M glycerol tended to favor 30°C as a final plunge temperature, whereas embryos frozen in 1.5 M glycerol tended to favor -35°C as a final plunge temperature. Overall, embryos tended to show a higher survival rate when frozen in 1.5 M glycerol. An embryo freezing protocol should therefore include the use of a 1.5 M glycerol solution, equilibrated in three steps of 10 minutes each. Embryos should be cooled to between -30°C and -35°C and plunged into liquid nitrogen. Thawing should take place in a 30°C water bath.

MAPLETOFT, R.J.

Induction of abortion in feedlot heifers with a combination of cloprostenol and dexamethazone

An experiment was designed to determine the mechanism by which dexamethasone causes abortion in cloprostenol-treated cows. Twenty-four beef cows at 201-206 days of gestation were treated with 500 μg cloprostenol (PG), PG plus 30 mg estradiol (PG-E), PG plus 25 mg dexamethasone (PG-DEX) or PG-DEX plus 200 mg progesterone (PG-DEX-P). Serum progesterone dropped to as low as 1.26 ng/ml in PG and PG-E group by 96 hours after treatment, but abortions did not occur. Serum progesterone dropped below 1 ng/ml by 48 hours in the PG-DEX group and by 72 hours in the PG-DEX-P group and all cows in both groups aborted. Although estradiol levels were significantly higher ($P<.01$) in the PG-E group than in the PG-DEX groups, no abortions occurred.

A field experiment was conducted to determine the efficacy of 500 μg cloprostenol and 25 mg dexamethasone in inducing abortion at all stages of pregnancy. At less than 4 months of pregnancy this treatment was 100% (37/37) effective in inducing abortion and at 4-8 months of gestation it was 92.5% (74/80) effective. A dose-response trial indicated that there was no significant difference in efficacy between a dose of 500 μg cloprostenol plus 25 mg dexamethasone and 375 μg cloprostenol plus 10 mg dexamethasone. Collectively, data indicate that the simultaneous administration of cloprostenol and dexamethasone in combination does constitute a reliable method of inducing abortion at all stages of gestation. Cloprostenol seemed to terminate an ovarian source of progesterone, whereas dexamethasone seemed to act by terminating a uterine (placental) source of progesterone.

MAPLETOFT, R.J.

Termination of pregnancy with cloprostenol and dexamethazone in intact and ovariectomized cows

An experiment was designed to determine the efficacy of a combination of cloprostenol and dexamethasone in inducing abortion in the cow. In the first experiment 24 cows were sham-operated (SH) or ovariectomized (OV) at 210 days of gestation and were treated with vehicle (VEH), 500 μg cloprostenol (PG), 25 mg dexamethasone (DEX) or 500 μg cloprostenol plus 25 mg dexamethasone (PG-DEX). Cows in SH-VEH, SH-DEX, SH-PG, OV-VEH and OV-PG groups calved near term. Three of four cows aborted at 3 ± 0.4 days after treatment in the SH-PG-DEX group and at 2.3 ± 0.3 days after treatment in the OV-PG-DEX group. All four cows in the OV-DEX group aborted 2.8 ± 0.4 days after treatment. At the time of surgery, mean (SE) jugular and uterine vein serum progesterone concentrations (ng/ml) were 11.4 ± 0.8 and 13.4 ± 0.6, respectively. On the day of treatment (72 hours after surgery), progesterone values of OV cows were significantly lower than SH cows ($P<0.1$). At 72 hours after treatment serum progesterone levels were significantly lower in OV and PG cows which received DEX than OV and PG cows which did not receive DEX ($P<0.1$).

Results indicate that dexamethazone will terminate pregnancy at seven months of gestation after the ovarian source of progesterone has been removed.

MURPHY, B.D.

Improving embryo survival in mink

Pharmacological and management means to improve embryo survival in ranch mink were investigated in field and laboratory trials. Augmentation of day length beginning soon after mating shortened gestation and there was a trend toward increased production. It was determined that excess light could be administered beginning 14 hours after dawn, and that this 90 minute pulse of light during the period from 14 to 15.5 hours after dawn could induce implantation in mink maintained on artifically short days. A synthetic hormone, medroxyprogesterone acetate, which has biological effects similar to the hormones of pregnancy did not enhance production, nor shorten pregnancy. However, pimozide, another drug which stimulated hormone release from the mink pituitary, shortened gestation and appears to have the potential to improve whelping success in ranch mink.

POLLEY, L.

A necropsy study of the occurrence of selected helminth parasitisms among horses in Western Canada

The parasitic nematode *Onchocerca cervicalis* occurs in horses in many parts of the world. The adult helminths are found in the nuchal ligament and the microfilariae in the dermis. A variety of clinical signs have been attributed to these microfilariae. In Canada, although clinically significant O.

Cervicalis infection has been reported in small numbers of horses in Quebec and British Columbia, the sole published survey of the prevalence of the parasite in horses, in Ontario and Quebec, included only 43 animals.

In an abattoir survey of 383 horses from the four western provinces of Canada and 240 horses from Washington, Montana and North Dakota prevalences of *Onchocerca* sp of 11.8% and 25.8% respectively have been demonstrated by umbilical skin specimen examination.

SEARCY, G.

Investigation of anemia and poikilocytosis in calves

Anemia and poikilocytosis are common findings in young calves. Ninety-eight calves were studied to determine if anemia and poikilocytosis were related to iron or copper status or hemoglobin type. No significant differences were found in serum iron, total iron binding capacity, marrow iron, plasma copper or hemoglobin type between affected and normal calves. Age was found to be an important factor influencing most of these indices. Calves less than six weeks of age had more poikilocytes, lower serum iron, higher total iron binding capacity, less adult and more neonatal and fetal hemoglobin than calves greater than six weeks of age. Poikilocytes were also strongly inversely correlated (-0.9177) with age. These age related changes are important in the interpretation of hematological parameters in calves.

CONTINUING GRANTS

Date following title identified Annual Report in which project description appears

AGRICULTURAL ENGINEERING

RAPP, E.
Evaluating drainage feasibility of some Alberta soils (1972-1973)

RAPP, E.
Irrigation scheduling for supplemental irrigation in Central and Northern Alberta) (1979-1980)

ANIMAL SCIENCE

AHERNE, F.X.
The use of electrolytes and crude immunoglobulins in curing and preventing pre-weaning and post-weaning scours in pigs (1980-1981)

AHERNE, F.X., R. BLAIR
Canola meal for starter and grower pigs - a collaborative study (1982-1983)

BERG, R.T.
Influence of selection for growth on maternal traits in mice (1982-1983)

BERG, R.T., M. PRICE, R.T. HARDIN
Strategies for beef cattle improvement (1980-1981)

HARDIN, R.T.
Rate of tissue growth and changes in body composition (1968-1969)

HARDIN, R.T.
Recombination of quantitative traits in sheep (1968-1969)

MILLIGAN, L.P., P.M. KENNEDY
Effects of soluble and bypass protein supplements on intake and utilization of straw (1981-1982)

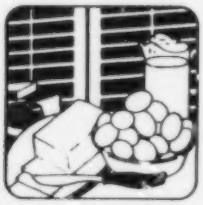
MILLIGAN, L.P., P.M. KENNEDY
Methods of protection of canola meal (1982-1983)

SAUER, W.C.
Lysine requirements of starter pigs (1981-1982)

SHIRES, A.
Effects of variable levels of dietary protein and energy, and periods of feeding on the rate of growth and carcass composition of meat-type chickens (1982-1983)

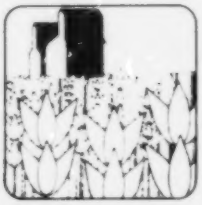
THOMPSON, J.R., F.X. AHERNE
Etiology of development of leg weakness in swine (1981-1982)

YOUNG, B.A.
Climatic influences on nutrition of cattle (1977-1978)



FOOD SCIENCE

OORAIKUL, B.
Dehydration of vegetables: Improvement in drying rate textural properties and rehydration characteristics of the products through physical and chemical pre-treatments (1982-1983)



PLANT SCIENCE

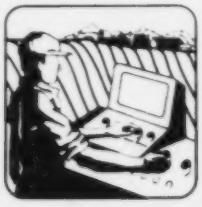
COLOTELO, N.
Role of exudates from aerial mycelium of Sclerotinia sclerotiorum and Fusarium species in pathogenesis (1973-1974)

HIRUKI, C.
Serological and anatomical studies on plant mollicute diseases with special reference to their diagnostic value (1979-1980)

HIRUKI, C.
Evaluation and development of practical diagnostic procedures for potato spindle tuber viroid disease in Alberta (1982-1983)

KNOWLES, R.H.
The behaviour of turfgrass growing on minimal medium in response to irrigation and nutritional inputs (1980- 1981)

VANDEN BORN, W.H.
Biology and control of cleavers (Galium aparine) (1981-1982)



RURAL ECONOMY

HAWKINS, M.H., M.M. VEEMAN
Market innovations and price behaviour - Alberta hogs (1980-1981)

NORBY, R.R., M.H. HAWKINS
Meat price relationships - farm, wholesale and retail (1980-1981)

PETERSEN, T.A.
Analysis of farm leases and rental arrangements in Alberta (1980-1981)

RICHTER, J.J.
The European agricultural export subsidy and the prospect of the Canadian grain trade (1981-1982)

SCHULTZ, W.M.
Financial planning models for Alberta farms (1981-1982)

SOIL SCIENCE

COOK, F.D.
Inoculum for pulses (1979-1980)

MacHARDY, F.V., F.D. COOK
Measurement of photosynthate requirement for nitrogen fixation by selected free-living microorganisms found in Alberta soils (1977-1978)

MacHARDY, F.V.
Assessment of nitrogen contribution to cereals by intercropping with annual legumes (1977-1978)

McGILL, W.B.
Acid phosphatase production in relation to plant-available P (1981-1982)

PLUTH, D.J.
Productivity ratings for soil types in Edson and Whitecourt map areas (1968-1969)

PLUTH, D.J.
Nutrient distribution and cycling in selected forest ecosystems (1968-1969)

ROBERTSON, J.A.
Factors affecting potassium availability in central Alberta soils (1982-1983)

WEBSTER, G.R.
Testing of a revised soil-moisture budget (1978-1979)

INTERDISCIPLINARY

ANDREW, W.T., K.W. DOMIER
The integration of seed pieces, cutter and planters for better plant stands in potato fields (1977-1978)

BERG, R.T., Z.J. HAWRYSH, M.A. PRICE
Assessment of optimum slaughter weight and condition in beef cattle (1979-1980)

CLEGG, L.F.L., W.T. ANDREW
Fertilizer and trace element studies (1974-1975)

DOMIER, K.W., W.T. ANDREW
A systematic study of potato cutters, seed pieces and planters (1980-1981)

ROBERTSON, J.A., K.W. DOMIER
Factors affecting P fertilizer utilization in tilled and untilled soils (1982-1983)

UNIVERSITY OF BRITISH COLUMBIA

COPEMAN, R.J.

Serological detection methods for Corynebacterium sepedonicum (1977-1978)

WESTERN COLLEGE OF VETERINARY MEDICINE

FORSYTH, G.W.

Control of intestinal secretion in Colibacillosis in pigs (1978-1979)

GUDMUNDSON, J., M.E. SMART

A survey of trace mineral metabolism in purebred and percentage simmental cattle (1978-1979)

POLLEY, L.R.

A necropsy study of the occurrence of selected helminth parasitisms among horses in Western Canada (1979-1980)

RAWLINGS, N.C.

The endocrinology and physiology of blastocyst implantation in the ewe (1978-1979)

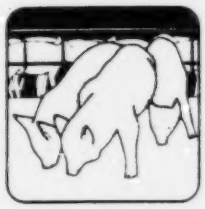
RAWLINGS, N.

The development and application of controlled breeding and artificial insemination in sheep (1982-1983)

STOCKDALE, P.H.G.

Immunological control of shipping fever in cattle (1979-1980)

NEW GRANTS - EFFECTIVE 1983



ANIMAL SCIENCE

AHERNE, F.X.

A study of the potential of increasing the reproductive efficiency of gilts

The annual replacement levels of sows in Canada is approximately 45 percent. Therefore the reproductive performance of gilts can greatly influence the overall reproductive efficiency of the sow herd. Gilts generally produce smaller litters than sows, do not reach puberty until 200 days of age, and are difficult to integrate into a batch-farrowing system.

The objective of this research is to examine several management systems which could increase the reproductive efficiency of gilts.

MATHISON, G.W.

Evaluation of aspen as a feedstuff for ruminants

There has been considerable interest in Alberta in the use of aspen as a cattle feed. Unfortunately there is little in vivo information available on the extent to which cattle can digest aspen, and even less on how much they will voluntarily consume. The objective of this research is to measure the voluntary consumption by cattle and sheep and digestibility of Alberta aspen by cattle and sheep and to make this information readily available to Alberta farmers, government employees, nutritionists, researchers and product development people.

MATHISON, G.W.

Effect of Bovatec® on the energetic efficiency of cattle

Ionophores have been developed (eg. Monensin or Rumensin® and lasalocid or Bovatec®) which have improved the efficiency of feed conversion in cattle. It is known that these compounds exhibit part of their effect by reducing the proportion of feed energy which is lost as methane. There is some question, though, whether the additional effects of ionophores are as a result of an improvement in the efficiency of use of metabolizable energy for growth or through a decreased maintenance requirement and/or an increased efficiency of diet energy use for maintenance (Byers 1980. J. Anim. Sci. 51: 158). It is of scientific importance to ascertain which of these mechanisms is correct and it is also of great practical importance since the products are widely used in cattle feeding.

SAUER, W.C.

The biological availability of biotin in feedstuffs for pigs

The objectives of the proposed studies are to determine:

1) the biological availabilities of biotin in commonly used feedstuffs for pigs,
2) the extent of biotin synthesis by the microbes in the large intestine and the availability of microbial-derived biotin to the pig.

The results that are obtained will provide information for accurate and economical levels of biotin supplementation to diets for growing and breeding pigs.

FOOD SCIENCE

JELEN, P.

Investigation of enzymatic lactose hydrolysis in development of a sterilizable whey-based fruit drink

Current industrial interest in developing a cottage-cheese whey-based fruit drink necessitates investigation into the technology and economics of lactose hydrolysis in cottage-cheese whey under acidic conditions. The objectives are to evaluate the enzymatic hydrolysis process in combination with ultrafiltration treatment to accomplish the lactose hydrolysis in the permeate and to recover the active enzyme in the retentate for possible subsequent use in ice-cream. The development of the whey drink would offer a new profitable product to the dairy industry in place of the current costly waste disposal problem, while the re-use of the enzyme for hydrolysis of lactose in ice-cream mixes would mean further savings to the industrial processor.

LE MAGUER, M.

Determination of the surface properties of biologically active immobilized molecules

Biologically active immobilized molecules can be used to effect such operations as lactose transformation, removal of antibiotics from milk and other far reaching industrial applications in the food processing industry. It is of crucial importance to increase their activity so as to improve their efficiency in industrial application. A study of the suitability of the inert support with regard to contact surface area and availability of the active molecule to the solution is therefore necessary.

OORAIKUL, B.

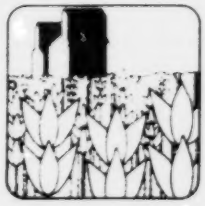
Development of recombined potato skin for the manufacture of instant baked potatoes

To develop a casing material which has characteristics of baked potato skin to be used for the manufacture of instant baked potatoes which could be microwave heated prior to consumption. Success of the development will lead to a significant increase in potato consumption in "baked" form which means greater sales and more jobs for potato and related industry.

WOLFE, F.H.

Calcium activated neutral protease levels in PSE pork muscle

The objectives of this research are to compare the CANP levels in PSE pork muscle to those found in normal pork muscle, and to determine the relationship, if any, between CANP and the physiological effects seen in PSE muscle. The significance to agriculture may be in a more complete understanding of the biochemical mechanisms underlying the quality deterioration seen in PSE pork meat.



PLANT SCIENCE

TOOP, E.W.

Selection of Begonia lucerna crosses for mass production as compact potted plants

The objectives are to select crosses and strains of *Begonia lucerna* that appear adaptable as acceptable pot plants and to establish procedures for their commercial greenhouse production as compact floriferous plants with minimal energy input. This technology for growing naturally cane-like begonias in a marketable size and shape will introduce another container-grown product to the trade. Container-grown products are becoming more and more important to local greenhouse growers since cut flower production is no longer competitive with imports.

WALTON, P.D.

The combining ability of alfalfa clones

The University of Alberta alfalfa breeding program has produced high yielding clones which show resistance to "alfalfa sickness". The best clones, selected on the basis of their *phenotypic* performance, were crossed to produce a number of new synthetic alfalfa strains. One of these strains (BR1) which performed well in Agriculture Canada Uniformity Trials is being considered for licencing in the fall of 1983. The objective of this project is to continue selection cycles and to study the *genotypic* performance of the existing clones. The cause of "alfalfa sickness" is not known so that it is impossible to make recommendations to prevent a disease attack. The production of a resistant cultivar would be of the utmost importance to Alberta farmers.

RURAL ECONOMY

BAUER, L.

An economic analysis of land ownership versus land leasing arrangements connected with livestock production in Alberta

The purpose of this project is to determine comparative operating costs with typical land ownership versus land leasing arrangements and various livestock production arrangements. An examination of alternative ownership arrangements in which the public interest is equally well served can also be undertaken. An important question raise by the livestock industry in Alberta is: What cost and return differences arise from owned versus leased land? An examination of production costs and returns as well as the historical influence of capital gains is involved in answering this question.

LEROHL, M.L.

Effects of domestic grain grades on the operating efficiency of Canada's west coast terminal elevators

Operational efficiency aspects of quality-segregation systems become particularly important in bulky, low-value commodities such as grains (Copeland Cramer; Hill). Accordingly, it is desirable that attention be devoted to operational efficiency criteria associated with optimum grading system approaches (e.g., Zusman), in order to assess the extent to which improved operational efficiency is possible by changes in the number of grades or types of grains handled by a typical terminal elevator operation. A focus on terminal elevator operations will permit including analysis of the staging aspects of the rail transportation system, and the manner in which those relate to the costs of grades and grains separation in a typical terminal operation. The proposed study (along with the earlier study by Hoar) is designed to provide farmers and the grain industry with an objective standard to judge the added costs, if any, associated with current grade separations, as well as a basis for judging cost implications of further possible separations such as additional protein grade categories for wheat.

SOIL SCIENCE

NYBORG, M.

Big pellets and deep bands

In Central and Northern Alberta fertilizer nitrogen typically doubles the yield of cereal grains and canola. However, nitrogen fertilizers are costly, and so increasing the efficiency of fertilizer nitrogen is practically important. In the three past years the yield increases of barley from fall-applied nitrogen fertilizer was significantly more with banding than incorporation but placing the fertilizer in "nests" gave by far the highest yields. Now commercial big pellets (same principle as "nests") are available from Europe, and the objective is to find if the big pellets produce good yields in the fall and spring and if they can be mechanically dispensed.

NYBORG, M.

Conversion of thiosulphate and sulphur emulsion to sulphate

Presently there is poor performance by many of the new non-sulphate sulphur fertilizers in the Prairie Provinces. These fertilizers differ greatly in their effectiveness in overcoming sulphur-deficiency in crops.

The objective of this small project is to experimentally compare the several new sulphur fertilizers, which are apparently the most effective in the field, so as to find those most suitable in Alberta.

NYBORG, M.

Elemental sulphur and nitrogen fertilizers

Sulphate-containing fertilizers effectively overcome crop-deficiency of sulphur, but these fertilizers (21-0-0-24, 16-20-0-14 and 33-0-0-11) do not mix well physically, and they often do not have a ratio of nitrogen to sulphur to meet nitrogen needs. Sulphur fertilizers based on elemental sulphur are now widely used because of facility of handling, but often they do not correct sulphur-deficiency. This project has two main objectives: (1) to find if once used elemental sulphur causes a semi-permanent increase in soil sulphur bacteria so that in subsequent years the fertilizer is more effective; and (2) to find if nitrogen placed with elemental sulphur speeds the release of sulphate.

WESTERN COLLEGE OF VETERINARY MEDICINE

BARTH, A.D.

A study of fertilization rates of semen from bulls with various levels of specific sperm defects

1. Determine fertilization rates of bulls producing morphologically normal and morphologically abnormal semen using superovulated heifers.
2. Compare results with non-return or pregnancy rates.
3. Develop a new classification system as to the relative importance of specific sperm defects.

Considerable evidence exists indicating that high levels of sperm defects affect non-return rates and subsequently pregnancy rates in cows to which they are mated. A certain amount of attention is paid to whether specific defects are "primary" or "secondary". However, little is known of the relative importance of the various sperm defects. It is likely that the "primary/secondary" classification is outdated and defects should be classified as "major/minor" or "important/unimportant". In this regard, the relative effects of various specific sperm defects on fertilization and subsequently pregnancy must be studied.

MAPLETOFT, R.J.

The induction of parturition in the bovine female using dexamethasone and prostaglandins in combination

1. To study the effectiveness of a simultaneous treatment combination of dexamethasone and PGF2α for induction of parturition and to compare with either alone;
2. To evaluate effects of treatments on endocrine parameters, retention of membranes, postpartum fertility and calf viability and survival.

If the combined effect of dexamethasone and PGF2α used simultaneously in late gestation can result in a more reliable and predictable induction with fewer problems than with either alone, the cattle producer could better plan and control management during calving to ensure the highest survival rate of cows and calves and to reduce labor costs. By contributing more information on the hormonal changes associated with normal and induced parturition, the veterinarian will be provided with another tool with which he can better serve his clients.

CONTRIBUTIONS
from sources listed are gratefully acknowledged
April 1, 1983 - March 31, 1984

Alberta Broiler Growers Marketing Board
Alberta Cattle Commission
Alberta Pork Producers Marketing Board
Alberta Potato Commission
Alberta Wheat Pool
Burns Meat Ltd.
Canadian Association of Animal Breeders
Canadian Mink Breeders Association
Canola Council of Canada
Chembiomed Ltd.
Coban Institute
Cominco Ltd.
Esso Resources Canada Ltd.
Federated Co-operatives Ltd.
Hoffman-Laroche Ltd.
International Minerals & Chemical Corporation
I & S Produce Ltd.
Masterfeeds - Maple Leaf Mills Ltd.
Northrup King Seeds Ltd.
Oseco Limited
Otto Pick and Sons Seeds Ltd.
Potash Corporation of Saskatchewan
Potash and Phosphate Institute
Prairie Seeds Ltd.
Rothwell Seeds Ltd.
United Feeds
Western Co-operative Fertilizers Ltd.

Total $185,432.00*

*Includes contributions in-kind such as chemicals, laboratory and field supplies, labour, etc.

ALBERTA AGRICULTURAL RESEARCH TRUST
FINANCIAL STATEMENTS
MARCH 31, 1984

Auditor's Report
Balance Sheet
Statement of Revenue, Expenditure and Unexpended Funds
Notes to the Financial Statements

ALBERTA LEGISLATURE

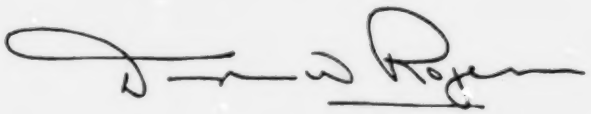
OFFICE OF THE AUDITOR GENERAL

AUDITOR'S REPORT

To the Trustees of the
Alberta Agricultural Research Trust

I have examined the balance sheet of the Alberta Agricultural Research Trust as at March 31, 1984 and the statement of revenue, expenditure and unexpended funds for the year then ended. My examination was made in accordance with generally accepted auditing standards, and accordingly included such tests and other procedures as I considered necessary in the circumstances.

In my opinion, these financial statements present fairly the financial position of the Trust as at March 31, 1984 and the results of its operations for the year then ended in accordance with generally accepted accounting principles applied on a basis consistent with that of the preceding year.



F.C.A.
Auditor General

Edmonton, Alberta
October 4, 1984

Statement A

ALBERTA AGRICULTURAL RESEARCH TRUST
BALANCE SHEET
AS AT MARCH 31, 1984

	1984	*1983*
ASSETS		
Current:		
Deposits in trust (Note 3)	$177,630	**$249,185**
Research grants recoverable	12,000	—
	$189,630	**$249,185**
LIABILITIES		
Current:		
Research grants payable	$ 500	**$143,567**
Administration charges payable	5,015	—
Unexpended funds, Statement B	184,115	**105,618**
	$189,115	**$249,185**

The accomanying notes are part
of these financial statements.

Statement B

ALBERTA AGRICULTURAL RESEARCH TRUST
STATEMENT OF REVENUE, EXPENDITURE AND UNEXPENDED FUNDS
FOR THE YEAR ENDED MARCH 31, 1984

	1984	*1983*
REVENUE		
Contributions from the Province of Alberta, Department of Agriculture	$250,000	$250,000
Contributions from industry	185,432	137,685
Interest	32,195	31,367
	467,627	419,052
EXPENDITURE		
Research grants	367,465	355,072
Administration charges	21,665	23,189
	389,130	378,261
Excess of revenue over expenditure	78,497	40,791
Unexpended funds at beginning of year	105,618	64,827
Unexpended funds at end of year	$184,115	$105,618

ALBERTA AGRICULTURAL RESEARCH TRUST
NOTES TO THE FINANCIAL STATEMENTS
MARCH 31, 1984

Note 1 Authority

The Alberta Agricultural Research Trust operates under the authority of the Alberta Agricultural Research Trust Act, Chapter A-14, Revised Statutes of Alberta 1980.

Note 2. Significant Accounting Policies

General

Research grants are recorded in these financial statements when approved for payment to researchers' accounts. Unexpended balances of grant funds held in researchers' accounts are not reflected in these financial statements.

Changes in Financial Position

A statement of changes in financial position is not provided as disclosure in these financial statements is considered to be adequate.

Note 3 Deposits in Trust

Deposits in trust consist of deposits in the Consolidated Cash Investment Trust Fund of the Province of Alberta.

Note 4 Approval of Financial Statments

These financial statements were approved by management on October 4, 1984.